July 2014 Name \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Unit 4 Test**

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| --- | --- |
| **Expectation** | **Level** |
| E1 - analyse technologies that use the wave nature of light, and assess their impact on society and the environment; |  |
| E2 - investigate, in qualitative and quantitative terms, the properties of waves and light, and solve related problems |  |
| E3 - demonstrate an understanding of the properties of waves and light in relation to diffraction, refraction, interference, and polarization. |  |

**Expectation E1**

**SHORT ANSWER**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | **Level 1** | **Level 2** | **Level 3** | **Level 4** |
| **Language** | uses conventions,  vocabulary, and  terminology of the discipline with limited  effectiveness | uses conventions,  vocabulary, and  terminology of the discipline with some  effectiveness | uses conventions, vocabulary, and terminology of the discipline with considerable effectiveness | uses conventions,  vocabulary, and terminology of the discipline with a high  degree of effectiveness |
| **Explanation of Topic** | Student indicates a limited understanding of their topic | Student indicates a basic understanding of their topic, with some errors or omissions | Student indicates a clear understanding of their topic | Student indicates an insightful understanding of their topic and includes limitations and constraints |
| **Makes connections** | Makes connections  between science,  technology, society, and the environment  with limited effectiveness | Makes connections  between science,  technology, society, and the environment with some effectiveness | Makes connections  between science,  technology, society, and the environment  with considerable  effectiveness | Makes connections between science, technology, society, and the environment with  a high degree of effectiveness |
| **Proposes actions to deal with problems** | proposes courses of practical action of limited effectiveness | proposes courses of practical action of some  effectiveness | proposes courses of practical action of considerable effectiveness | proposes highly effective courses of practical action |

**Choose 1 of the following to explain fully.**

1. How has holographic technology made it more difficult to counterfeit Canadian currency?
2. In what ways does the use of lasers in surgery improve surgical techniques and recovery time?
3. In what ways can posting magazines or newsletters on the Internet, rather than printing and distributing them, benefit the environment?

**Choose 1 of the following to explain fully.**

1. How do geologists use the wave nature of light to find mineral deposits?
2. How do surface plasmon polaritons (SPPs) make use of the wave nature of light? What are some of the applications of SPPs?
3. How does the global positioning system (GPS) use the wave nature of light? What are its applications? What are its shortcomings?

**Expectation E3**

**SHORT ANSWER**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | **Level 1** | **Level 2** | **Level 3** | **Level 4** |
| **Language** | uses conventions,  vocabulary, and  terminology of the discipline with limited  effectiveness | uses conventions,  vocabulary, and  terminology of the discipline with some  effectiveness | uses conventions, vocabulary, and terminology of the discipline with considerable effectiveness | uses conventions,  vocabulary, and terminology of the discipline with a high  degree of effectiveness |
| **Explanation of Topic** | Student indicates a limited understanding of their topic | Student indicates a basic understanding of their topic, with some errors or omissions | Student indicates a clear understanding of their topic | Student indicates an insightful understanding of their topic and includes limitations and constraints |
| **Organization** | expresses and organizes ideas and information with limited effectiveness | expresses and organizes ideas and information  with some effectiveness | expresses and organizes ideas and information  with considerable  effectiveness | expresses and organizes ideas and information  with a high degree of  effectiveness |

1. Describe and explain the diffraction and interference of water waves in two dimensions.
2. Explain how mirages are formed in a desert. OR Explain why we see different colours in a puddle of oil.

**Expectation E2**

1. Briefly describe what is meant by the following terms **[L3]**
   1. Nodal line
   2. Destructive interference
   3. Wavelength
   4. Standing wave
   5. Polarization

**PROBLEM SOLVING**

**Question 1 [L3]**

An interference pattern is formed on a screen when a helium-neon laser light (λ=6.328x10-7 m) is directed towards it through two slits. If the slits are 43 μm apart and the screen is 2.5 m away, what will be the separation of adjacent nodal lines?

**Question 2[L4]**

A 5.0 Hz water wave, travelling at 31 cm/s in deep water, enters shallow water. The angle between the incident wave front in the deep water and the boundary between the deep and shallow regions is 50°. The speed of the wave in the shallow water is 27 cm/s. Find

(a) the angle of refraction in the shallow water

(b) the wavelength in shallow water

**Question 3 [L4]**

Two identical point sources 5.0 cm apart, operating in phase at a frequency of 8.0 Hz, generate an interference pattern in a ripple tank. A certain point on the first nodal line is located 10.0 cm from one source and 11.0 cm from the other. What is

(a) the wavelength of the waves?

(b) the speed of the waves?